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REPLY TO: 3430 Evaluation

March 19, 1980

SUBJECT: Biological Evaluation of Hanna Flat Campground

TO: Forest Supervisor, San Bernardino N.F.



On December 20, 1979 Dave Schultz and John Pronos from the FIDM Staff examined the Hanna Flat Campground. Personnel on the Big Bear Ranger District had been aware for some time that mistletoe and root disease were present in the campground. A proposed sale in the stands surrounding the campground presents an opportunity to do some maintenance or improvement work in the campground at the same time.

Hanna Flat campground lies at about 7,000 ft. elevation. Annual precipitation from 1965 through 1978 at the nearby Big Bear Dam recording station averaged 29.53 inches, but during that timespan it ranged from a low of 12.14 inches to a high of 64.08 inches. The overstory stand in the campground consisted of Jeffrey pine, white fir, black oak and smaller amounts of incense-cedar and juniper. The understory, where it existed, was largely white fir and Jeffrey pine. Stand stocking ranged from 0 to over 400 sq. ft. basal area, and most aggregates were adequately stocked to overstocked. Most of the areas with sparse tree cover were fully occupied by brush, primarily manzanita and Ceanothus. Rodent burrows were extremely common in the open areas which may explain the lack of conifer reproduction.

#### EVALUATION

We examined the entire campground and have summarized the insect and disease problems found there according to tree species. The number of dead and dying trees currently in the campground is fairly low and includes three Jeffrey pine and about 20 white fir.

Jeffrey Pine - The most immediate cause of pine mortality was the Jeffrey pine beetle (Dendroctonus jeffreyi). Several other underlying causes of mortality were present and additional tree death can be expected, particularly if there is a period of low precipitation. A factor contributing to the recent death of a Jeffrey pine at campsite #44 was the new road paving that cut off available air and/or water to one-half or more of the tree's roots. A second pine, at campsite #35, was still alive, but the road cut and paving have eliminated about one-half of the roots, and it cannot be expected to survive very much longer.

Two old growth Jeffrey pine (north of campsite #40) currently have

dying branches and off-color foliage. These trees are located within a fairly large Fomes annosus root disease center which extends between campsites #41 and #38 north to road 3N14. No other Jeffrey pine were currently dead or dying in annosus centers even though we found eight confirmed or suspected centers. Figure 1 shows the locations and approximate boundaries of these active root disease areas. Centers were "confirmed" if F. annosus conks were present in nearby stumps or if laboratory incubation of wood samples produced growing colonies of F. annosus. A "suspected" center showed the general pattern or appearance of typical root disease areas, but no conks were present in stumps. We did not cut into the roots of healthy trees to collect wood samples in these suspected centers.

A recently cut dead Jeffrey pine (campsite #32) and many others with dead tops (campsites #27-34) are located on the west end of the campground where the soil is thinner and rock outcrops are more common than the rest of the campground. Although there are not many trees in this area, the abundant brush is probably a serious competitor with the trees for the available soil moisture. Competition for moisture is probably also the underlying cause of the death of an old growth Jeffrey pine at the east end of the campground (W. of campsite 61) where a dense white fir thicket encircled the dead tree.

Dwarf mistletoe infection of pine was confined to the northwest section of the campground between sites #1 and 35. Many of the understory trees in this area had light to moderate infection, while the overstory trees had either no or very light infection. It appeared that past high pruning in the campground had eliminated dwarf mistletoe infections from the lower crowns of larger trees. The worst mistletoe was in the dense aggregates of young pine (basal areas = 280-400 sq.ft.) between campsites #41 and #39.

We concluded that the overall level and distribution of pine dwarf mistletoe in the campground did not warrant a separate and distinct control project. Rather, the existing mistletoe problem could be dealt with, and reduced to a tolerable condition, by thinning and pruning as part of an overall campground vegetation management program.

White-fir - One of the major factors contributing to white fir mortality in the campground is overstocking. Some of the sapling and pole size white fir aggregates have basal areas in excess of 400 sq.ft. In spite of the fact that there were 43.69 inches of precipitation at Big Bear Lake Dam in calendar year 1978, extreme moisture stress in the white fir aggregates was indicated by the fact that numerous small twigs are currently dying due to twig beetles, Pityophthorus spp. (Campsites #15-18, 50-55, 80-85).

Some of the old growth white fir near the southeast border of the

campground (campsites #47-61) have true mistletoe infections, Phoradendron bolleanum (no dwarf mistletoe of white fir was observed in Hanna Flat). Several of the old growth trees in the area have recently died, and true mistletoe was involved, but the age of the trees, and the fact that the site changes to a steep rocky slope, probably had a greater effect on the vigor of the trees. Except for pruning out infected branches or removing mistletoe plants, there is no practical control for true mistletoe in large firs.

A group of about six recently dead sapling and pole size white fir near campsite #55 was examined. The immediate cause of death was the fir engraver (Scolytus ventralis), but the trees had been predisposed by Armillaria root disease caused by Armillaria mellea. The root disease had spread out from a dead oak tree which the fungus used as a food base after the firs had overtopped and shaded out the oak.

Black oak. Oaks are scattered throughout the campground, and some are declining because they are being shaded out by conifers (campsites #17, 39, 53-55, 85). Dead and dying oaks may initiate an Armillaria root disease problem as described above in white fir. Healthy oaks are not normally affected by this fungus, however, once they are weakened they may be attacked, and A. mellea is then capable of spreading to and killing nearby conifers. All tree species in Hanna Flat Campground are susceptible to this root disease.

High risk and hazard trees. This category includes any trees that have a high probability of bark beetle attack, or that are hazardous because they have been significantly impacted by a variety of insect, disease, environmental or mechanical stresses. Symptoms of these damaged trees include:

1. Poor growth
2. Dead tops
3. Flat topped crown
4. Off color foliage
5. Reduced needle length and retention
6. Excessive lean
7. Open bole cankers with decay
8. Heavy mistletoe infection
9. Low live crown ratio.

We saw between 10 and 20 high risk/hazard trees in the campground, and because of the poor chance for survival or the good chance for failure.

they should be considered for removal.

#### MANAGEMENT CONSIDERATIONS AND OPTIONS.

There are several actions that may be taken separately, or in combination, as part of a comprehensive campground management plan to reduce the impact of pests and an unfavorable environment in Hanna Flat campground. They are discussed below:

##### A. Thinning to:

1. Reduce moisture stress and competition. - The greatest threat to the maintenance of an attractive tree cover in the campground at this time is overstocking. Both the white fir and the Jeffrey pine are showing signs of moisture stress, as evidenced by the widespread occurrence of twig beetles, and the situation can be expected to worsen if precipitation is below normal. The action that will produce the healthiest stand would be to adjust the stocking level of each aggregate to a basal area that could be supported in a year of low precipitation. The stocking level that can probably be supported in the Jeffrey pine aggregates which have little brush or grass competition would be about 100-120 sq.ft. basal area. The areas near the edges of the campground where the soil becomes thinner, and also aggregates which support abundant brush and grass cover will not be able to carry as much basal area over long periods of time. The brush and grass are very serious competitors with trees for the available soil moisture, and their presence also provides habitat for small rodents.
2. Reduce risk of bark beetle attack. - The rationale behind thinning is to improve the vigor of the stand and make the trees more resistant to bark beetle attacks. Although thinning and bark beetle attacks both result in fewer trees in the residual stand, the spatial pattern resulting is usually very different. Most bark beetles are known to produce a chemical attractant, or pheromone, shortly after a successful attack has been made on a host tree. The pheromone attracts other beetles of the same species into the general area of the tree under attack, and in some cases they may land on other nearby trees and kill them through their sheer numbers. Tree killing due to mass attacks by bark beetles often results in discrete clumps of mortality with live trees between the clumps; a pattern now present in Hanna Flat campground. On the other hand, a planned thinning operation would allow District personnel to select the trees to be removed and thereby control residual tree spacing.

3. Selectively remove dwarf mistletoe infected understory trees. Jeffrey pine dwarf mistletoe is present in the campground in trees of all sizes, but its occurrence is spotty and no brooms caused by dwarf mistletoe were seen. The effects of a heavy dwarf mistletoe infection on the host are similar to a drought, and these effects are compounded during periods of low precipitation. Some improvement in the current and future vigor of the Jeffrey pine in the campground, as affected by dwarf mistletoe, can be achieved during other thinning and high risk or hazard tree removal work. Some clumps of young Jeffrey pine, for example south of campsite #40, are very dense and also heavily infected with dwarf mistletoe. Thinning would reduce the impact of the dwarf mistletoe on the residual trees, and in the process the trees with very little or no infections could be favored as residuals. As long as old growth infected Jeffrey pine remain in the campground, reproduction near them will continue to become infected. Removing all of the sources of dwarf mistletoe would involve considerable cutting and result in an unattractive campground, but simply removing the high risk and hazard trees would reduce some of the sources of dwarf mistletoe seed.
4. Release oaks. Dying or declining oaks can create conditions favorable for the buildup of Armillaria root disease. Oaks are resistant to annosus root disease and can provide a buffer between root disease centers and healthy adjacent conifers. These hardwoods also impose barriers to the spread of dwarf mistletoes if they are between susceptible conifers. For these reasons it is beneficial to maintain healthy oaks by removing competition.
- B. High risk tree removal. Old growth specimen trees are often desired in campgrounds because of their aesthetic appeal. In a few instances thinning may improve the vigor of nearby old growth trees, but in some old growth aggregates thinning may be inappropriate. Group kills in old growth aggregates can often be avoided, or postponed, by removing the tree(s) most likely to be attacked by bark beetles, before the trees come under attack. These high risk trees can usually be recognized by the outward signs of low vigor and slow growth mentioned previously.
- C. Protective sprays. High value pines may be treated with residual bark sprays to prevent successful bark beetle attacks. This would be particularly helpful for trees likely to be significantly disturbed by any kind of construction. Two compounds currently registered for such use are Sevimol 4 and lindane.
- D. Hazard tree removal. All trees with excessive lean should probably be considered hazardous because 3 trees (Campsite 21, N. of Campsite

#38, SE of Campsite #70) have already fallen. Other hazardous trees might include those trees with a large portion of the roots cut off or exposed and trees with large dead tops or branches.

- E. Borax stump treatment. Borax treatment is 90% effective in preventing the infection of newly created stump tops by Fomes annosus. It therefore prevents the start of new root disease centers, but, unfortunately, has no effect on active existing centers. Borax treatment is a routine procedure in southern California recreation areas and is mentioned here in order to emphasize the importance of treating all conifer stumps.
- F. Oak revegetation of annosus centers. As mentioned previously, oaks (and most hardwoods) are resistant to annosus root disease, and are the only trees currently in the campground that will survive if planted within active disease centers. If hardwoods were planted around infection centers they could interrupt the continuous root contacts between conifers and eventually slow down or halt disease spread. The pathogen should eventually die out in centers so that conifers could be regenerated, but our current knowledge indicates that this could take as long as 50 years.
- G. Brush removal. - Brush removal would reduce some of the low screening between campsites, but in many parts of the campground it would increase the stocking level that could be safely carried for long periods of time, and it might speed up the establishment of natural regeneration to provide future tree cover.

Our Staff is available for any clarification or supplementary information concerning the technical content of this evaluation. Do not hesitate to request additional input for incorporation of insect and disease considerations into campground management plans. In appropriate situations FIDM funds are available for projects involving protective sprays or dwarf mistletoe control.

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Figure 1. Locations of Fomes annosus root disease centers in Hanna Flat Campground.



